DRAFT

CONCEPT OF OPERATIONS (CONOPS)

FOR

UNMANNED UNDERWATER VEHICLES (UUV) FROM SURFACE MINE COUNTERMEASURES VESSELS (SMCMV)

June 2005

PREFACE

1. SCOPE

This publication provides overarching operational concepts for the employment of UUVs (Man Portable, Light Weight, and Heavy Weight) from Surface Mine Counter Measures (SMCM) Ships. It describes the characteristics of the UUV, UUV Mine Countermeasures (MCM) tasks, and typical organization and command and control of the UUV. It further provides the information necessary to identify, nominate, and select missions appropriate for the UUV in an MCM role.

2. PURPOSE

This publication has been prepared under the direction of Commander Mine Warfare Command (CMWC) in conjunction with the SMCM UUV Working Group (WG). It sets forth the operating concept for the UUV system in the performance of independent and cooperative MCM operations. As an operating concept, it provides principles and basic themes. The framework is based on the MCM Mission defined in *The Navy UUV Master Plan 2004*. Built on the foundation of the CNO and CMC *Sea Power 21* implementation of SECNAV's *Naval Power 21* vision.

3. APPLICATION

This concept describes the operation and employment of the UUV system, as it is intended to be employed from SMCM Ships in the present (UOES), near term (FY07 - POC), and midterm (FY11 - IOC); with today's organizations, methods, and present and future technologies. It provides the underlying concepts for the development of Doctrine, Organization, Training, Material, Leadership, Personnel, and Facilities (DOTMLPF). The key contributor to the development of Technology Readiness Levels and available resources programmed by the OPNAV resource sponsor is the Office of Naval Research.

EXECUTIVE SUMMARY

This publication introduces notional present, near term (FY07), and mid term (FY11) operating concepts and projected functional capabilities of the SMCM UUV Systems to accomplish the MCM operational objectives defined in the Comprehensive MIW CONOP. The terms "present, "near term" and "mid term" are tied to the availability of enabling technologies. Program Executive Office (PEO) MUW Instruction 3370.1 identifies the key measures of effectiveness for MCM systems as ***time*** and ***risk***. Therefore, the key overarching goals for this program are to: 1) Reduce the overall time required to effectively execute the mission, and 2) Reduce the risk to operating forces.

Navy experience with employment of UUVs in Operation Iraqi Freedom, Anti-terrorism/Force Protection (AT/FP), and Homeland Defense missions has demonstrated the operational value that UUVs contribute to reducing tactical timelines and risk to operating forces.

OPNAV (N75B) and CMWC, through the Concept for Experimentation and Employment of Prototype Unmanned Underwater Vehicles (UUV) for the Surface Mine Countermeasures Vehicle (SMCMV) Initiative, demonstrated UUV potential for:
Reduced tactical timelines
Reduced risk to manned vessels
Extended operating range into shallower and confined waters
Contact classification using high resolution sonar imagery
Conducting MCM operations in non-permissive areas
Accurate contact localization
Employment from a variety of platforms
Low observable operations
Environmental data collection

This initiative has also identified the following challenges associated with the employment of UUVs:
Shipboard integration
Unique manning requirements (i.e. training, diversity of skills)
Launch and recovery
Data processing and post mission analysis
Sensor, endurance, and communication capabilities

These challenges will be addressed through the use of an evolutionary acquisition strategy and a robust technology development and demonstration program. For example, buried mine detection is a critically needed capability for future spirals.

Following the execution of the Concept for Experimentation and Employment phase, the User Operational Evaluation System (UOES) phase will utilize fleet experience with mature prototypical UUVs to refine this CONOP. In addition, through continued

employment, the multi-year UOES phase will provide the basis of first generation requirements and validated Tactics, Techniques, and Procedures (TTP).

The evolving Sea Power 21 pillars of Sea Shield and Sea Basing require reduced timelines for naval operations. SMCM UUV systems can be employed by surface ships, including the Littoral Combat Ship (LCS), Avenger-class (MCM 1), Craft Of Opportunity (COOP), and from the shore. The employment of prototype UUVs for the SMCMVs initiative demos has shown the current state of technology enables us to make realistic predictions of an achievable implementation of the Navy UUV Master Plan.

The SMCM UUV program addresses deficiencies identified by the Joint Undersea Superiority (JUSS) study. UUV systems can expedite the MCM tactical timelines associated with underwater search operations by detection, classification, and localization of underwater objects. Eventual identification and neutralization of threat mines will be achieved through continued Office of Naval Research investment.

The data collected by SMCM UUVs supports Intelligence Preparation of the Battlespace (IPB) by conducting Rapid Environmental Assessment (REA) of ocean volume and bottom data. Accurate characterization of the battlespace, provided by REA, results in the optimal employment tactics, mission planning, and utilization of MCM assets.

Initial use of SMCM UUVs will address the following high-priority tactical situations (TACSITS):

- **Route/SLOC clearance**
- **Port Break-In/Out**
- **Preparation and clearance of Amphibious Operating Area**
- **Preparation and clearance of Operating Areas**

SMCM UUV systems will add both capability and capacity to MCM forces. Therefore, they will serve as force multipliers and augment legacy systems to realize more rapid MCM operations while providing redundancy in mine detection, classification and eventually identification. With the addition of off board sensors, the MIWC will have the option to utilize assets in both supportive and independent roles. As an example: During the Port Break In/Out the SMCMV could work the seaward edge and project the UUVs to work simultaneously from the shore side of the route applying parallel vice serial efforts.

OPERATING CONCEPT

1. INTRODUCTION

This publication provides basic operating concepts and capabilities to prepare the combatant commanders and subordinate joint force commanders for employment of UUV equipped SMCM forces. In areas where mines have been used, low observable MCM is an integral part of enabling battleforce access and creating a common operational picture in the contested littorals.

Future MCM force composition could be comprised of US, NATO and/or other foreign nations. These UUV systems must be able to interoperate with their legacy MCM systems and other UUVs from a tactical and performance perspective. The U.S. Navy is participating in the parallel development of a NATO Experimental Tactics (EXTAC) document for the employment of these systems.

1.1 BACKGROUND

Traditional naval Mine Countermeasures (MCM) missions involve slow and deliberate processes. This can significantly impact the timetable of any maritime operation. Currently, surface MCM platforms are primarily tasked with littoral MCM operations. This translates into surface ships conducting area search, contact detection (or reacquisition of a previous contact located by another MCM asset), contact identification and neutralization missions, all sequentially, one mine at a time.

OPNAV (N75B) and CMWC, through the Concept for Experimentation and Employment of Prototype Unmanned Underwater Vehicles (UUV) for the Surface Mine Countermeasures Vehicle (SMCMV) Initiative, a non-acquisition program as defined within SECNAVINST 5000.2B (dtd 06 Dec 1996), provides the ability to conduct concept developmental testing and evaluation without directly resulting in the acquisition of a system or equipment for operational deployment. The first portion of this initiative will be executed as a non-acquisition program.

1.2 OPERATING ENVIRONMENT(S)

UUVs can be operated in both littoral and open sea environments throughout the world. During the notional operational sequence the UUV will be powered while on deck, launched and recovered, operated at the surface, and operated under the water. Each of these unique environments has its own challenges, refer to Tables 1-1 and 1-2 for UUV limiting conditions.

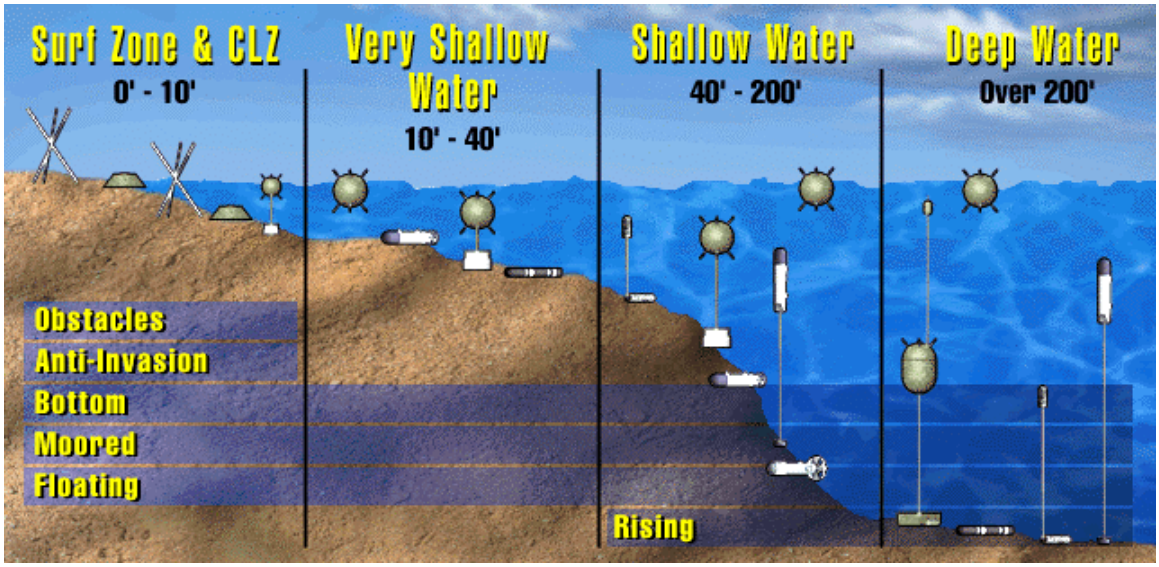
Condition	Operating Range	Deck	L & R	Surface	UW
Air Temp	0°F (-18°C) to 109°F (43°C)	X	X		
Sea State	SS 0-3 (SS-3 defined as wind velocity of 12 –16 knots with an average wave height of 0.5 – 1 m.)	X	X	X	X*
Current	<=2 knots in any direction		X	X	X
Salinity	0-50 ppt		X	X	X
Biologic	i.e. Sargasso Seaweed, Kelp, etc…		X	X	X
Water Depth	30 to 300 feet				X

Table 1-1 Natural Limiting Conditions

* Stability of UUVs for minehunting is affected by wave action as the vehicle approaches the Very Shallow Water (VSW) region

Condition	Deck	L & R	Surface	UW
Oil Contamination	X	X	X	
Surface traffic		X	X	
Fish Nets			X	X
Oil wells and other obstructions			X	X

Table 1-2 Man-made Limiting Conditions



Littoral Mine Threats

2. DESCRIPTION

Use of an accelerated evolutionary acquisition strategy to design a minimally acceptable capability for the fleet to use quickly; and through user interaction, maximize the capability in a minimum time frame. This strategy begins by fielding a baseline capability of Search, Classify and Map, and if possible, a Reacquisition and Identification capability. The strategy is then to field future generations of UUVs with higher level capabilities such as: higher resolution sensors with higher Area Coverage Rate, detection and classification of buried mines, precise navigation, and near real-time communications.

- Use will be made of experimentation events including the employment of the User Operational Evaluation System (UOES) concept to utilize fleet experience with early units to validate Tactics, Techniques, and Procedures (TTP), notional CONOPS, and to refine requirements.
- This acquisition strategy should produce a Preliminary Operational Capability (POC) in FY07 and an Initial Operating Capability (IOC) in FY11.

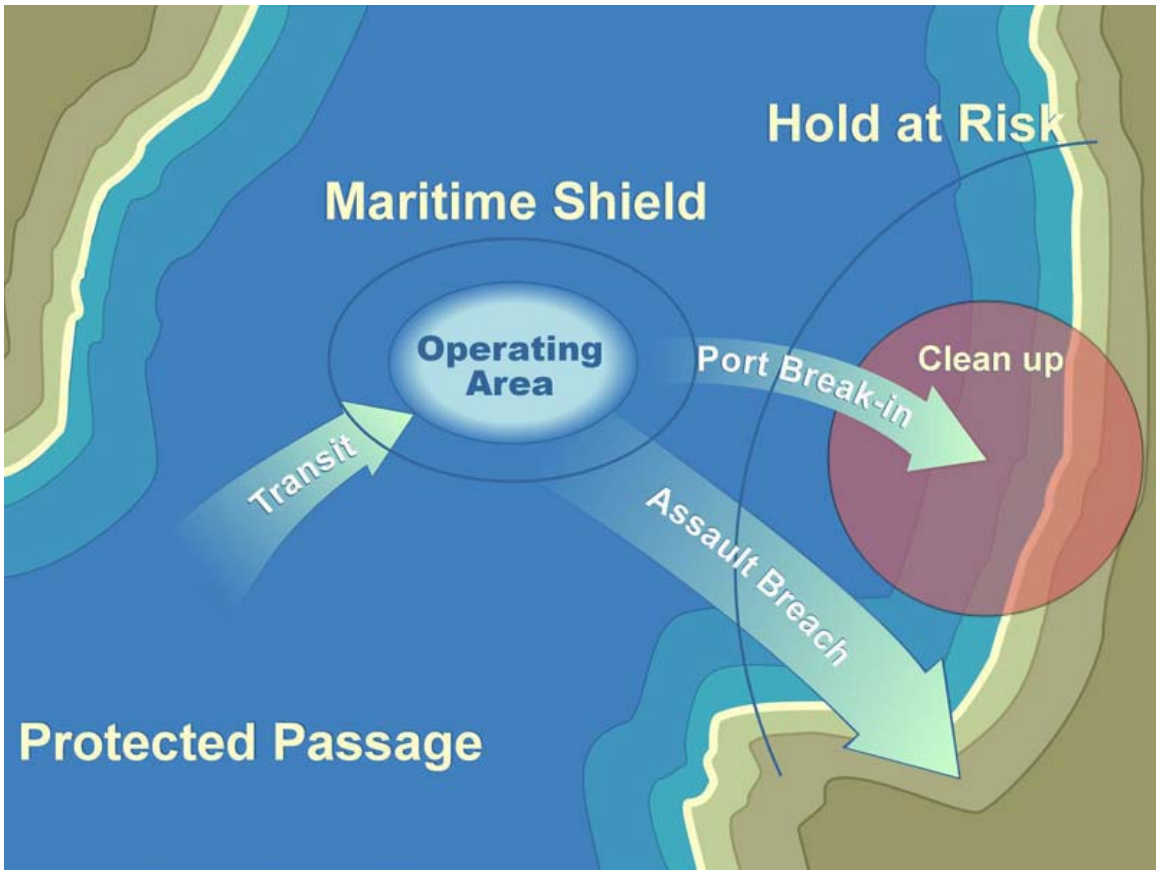
The evolutionary spiral development of UUV capabilities:

- 1st Generation (UOES) – Preliminary TTP and augmentation of legacy systems.
- 2nd Generation (POC system) – Validated independent UUV operation realizing traditional MCM roles.
- 3rd Generation (IOC system) – Buried mine detection capability realized.
- Future Generation – Enhanced UUV operational capabilities with increased effectiveness and efficiency in the performance of comprehensive MCM operations.

3. MINE COUNTERMEASURES

MCM includes all offensive and defensive measures for countering a naval mine threat. Offensive MCM consists of any actions implemented to prevent the laying of mines, eliminating or substantially reducing the degree of risk to platforms, systems, and personnel. Defensive MCM operations reduce risk after mines are laid and are classified as either passive or active.

- Passive MCM includes those measures, which reduce the risk from mines without physically removing them, such as signature reduction and mine avoidance.
- Active MCM includes measures that physically remove the mines such as sweeping and hunting. For the scope of this CONOPS these UUVs will not be designed to perform sweeping tasks.



Mine Warfare (MIW) Mission Areas

3.1 MINE COUNTERMEASURES OBJECTIVES

The selection of an objective is jointly determined by the Officer in Tactical Command (OTC) and the MCMC. The selection is based on the operational mission of the forces under the command of the OTC and the availability of MCM forces. MCM objectives are:

3.1.1. EXPLORATORY-RECONNAISSANCE OBJECTIVE

The purpose of the exploratory phase is to determine the presence of mines or to infer their absence. The purpose of the reconnaissance phase is to determine the extent of the mined area and the number and types of mines.

3.1.2. BREAKTHROUGH OBJECTIVE

Open generally narrow channels and staging areas for an amphibious assault or port breakout. The key element of this objective is that time is the critical factor.

3.1.3. ATTRITION OBJECTIVE

Keep the threat of mines to traffic ships as low as possible when traffic must transit

mined waters for a comparatively long period and the mines cannot be cleared in a short time or when re-seeding is suspected.

3.1.4. CLEARING OBJECTIVE

Remove or neutralize all mines from the assigned area.

3.2. UUV MCM FUNCTIONS

In support of the above MCM objectives, the UUV system will perform some or all of the following MCM functions:

3.2.1. DETECT (D)

Discovery by any means the presence of an object or phenomenon of potential military significance (synonymous with Search (S)). Find contacts.

3.2.2. CLASSIFY (C)

Evaluation of a detected item to determine if a contact is a Minelike Contact (MILC).

3.2.3. LOCALIZE (L)

Establish the precise position of an underwater object relative to specific navigation reference position (synonymous with Map (M)).

3.2.4. REACQUIRE (R)

The ability of a system to localize a contact that was previously located by self or other system.

3.2.5. IDENTIFY (I)

Determine the exact nature of an object that has been detected and classified. Determine that a MILC is a Mine or Non-Mine.

3.2.6. NEUTRALIZE (N)

Render the mine incapable of actuating against passing traffic.

3.2.7. VERIFY (V)

Determine the result of the neutralization effort when sufficient time exists.

The vision of the UUV Master Plan is one in which multiple vehicles with various capabilities, in tandem with other MCM systems, perform complimentary functions in the prosecution of mines in the area of interest. If movement from single vehicle operations to the vision of the UUV Master plan is to be effected the ability to reacquire and identify (RI) mine like (MILOC) contacts localized by other vehicles or systems is a basic capability that should be present in every vehicle that is part of the SMCM Tool Box.

3.3. PRESENT UUV CAPABILITIES. UOES (FY05)

- Minehunting:
  - Determine the presence of Mine Like Contacts (MILCs)
  - Detect, Classify, Localize (DCL) to attain higher levels of clearance
  - Reacquire contacts reported with other systems
  - DCL for Rapid Follow-On Clearance (RFOC)
- Employment :
  - Employable on a multitude of platforms with limited impact.
  - Rapidly deployable
  - Enables Day & Night operations
- Force multiplier and risk reduction agent, ability to employ:

  - Concurrently and independently from the host platform
  - Used to search Mine Danger Areas (MDA) while SMCM continues on Q-route
  - Multiple UUVs concurrently
  - Multiple UUVs operating collaboratively

- Increase safety to personnel and host platform by allowing host ship to stay outside of mine danger areas

- Operating Areas:
  - Extends the MCM operating depth range to shallower depths not achievable with shipboard sensors
  - Operate in confined waters, harbors & ports
  - Project UUVs to focus assets on multiple fronts (e.g., ingress and operate from shore side of breakout)

- Navigation accuracy sufficient to allow localization and/or reacquisition of contacts

- Perform low observable operations to prevent cueing enemy of MCM or further military plans

- Limited self protective MCM capability to a Craft of Opportunity (COOP)

3.4 NEAR-TERM CAPABILITIES - POC (FY07)

For the Preliminary Operational Capability (POC) system, the ability to confirm the presence of MILCs and then estimate the number of MILCs is central to this capability. The ability to identify mines is desired.

The use of Computer Aided Detection/Computer Aided Classification (CAD/CAC) reduces Post Mission Analysis time and the capability of vehicle onboard CAD/CAC to redirect RI vehicles will also reduce the overall mission time. Thus an initial UUV cooperative behavior by vehicle CAD/CAC to redirect RI vehicles is needed for POC.

The current speed at which data is transferred from the vehicle to the Local Area Network (LAN) is slow enough that it is the limiting factor in vehicle turn around time. For POC this time should be reduced.

3.5 MIDTERM CAPABILITIES - IOC (FY11)

For the Initial Operational Capability (IOC) system, the ability to confirm the presence, estimate the number of MILCs, and the ability to reliably identify the mine for further prosecution is required. Vehicles in the SMCM Tool Box for IOC should be able to avoid obstacles while performing their mission. The Tool Box system should also be able to fuse data from multiple unmanned system sensors and undertake undersea Search & Survey of relatively large areas.

Working with other MCM systems, the systems within the SMCM Tool Box should perform complimentary functions in the prosecution of mines in the area of interest such that they satisfy all MCM objectives, as well as extend operating range and duration. For IOC this will be accomplished by extending sensor area coverage, as well as extending communication range and bandwidth. The capability to find the slightly buried mine is desirable for IOC as well as an increased ability to navigate accurately at data collection altitude for extended periods throughout the sortie while producing near ID quality acoustic images (1" X 1" resolution).

For IOC the SMCM Tool Box should include launch and recovery methods usable on small boats, SMCMV, LCS, crafts of opportunity, and from the shore. The methods need not be universal, but they should be comprehensive.

Within the SMCM Tool Box at IOC should be a single Post Mission Analysis (PMA) and Bottom Mapping Workstation (BMW). Additionally, it is desired that there be improved MEDAL mission planning and data download capability, improved CAD/CAC accuracy and improved on-board CAD/CAC capability.

3.6 FUTURE CAPABILITIES.

For future spirals the tools available for SMCM should include the ability to neutralize identified mines. This probably will not be within the SMCM UUV capability but the ability to cooperatively engage identified mines is needed. This cooperative behavior should include collaboration with VSW/Shallow Water (SW) unmanned systems as well as adaptation to insitu environmental conditions. Other desired adaptive behaviors include the ability to alter initial mission profile to successfully complete tasks, accepting new tasks from other systems and onboard integration of vehicle control, sensor, CAD/CAC, navigation, and communication sub-systems.

Improved buried mine detection is another desired Planned Position Indicator (PPI) for future spirals as well as over the horizon (OTH) operations.

4. INTELLIGENCE PREPARATION OF THE BATTLESPACE

Intelligence preparation of the Battlespace, as defined by JP-02, is an analytical methodology employed to reduce uncertainties, concerning the enemy, the environment, and terrain for all types of operations. IPB builds an extensive database for each potential area in which a unit may be required to operate. The database is then analyzed in detail to determine the impact of the enemy, environment, and terrain on operations.

Maritime IPB includes the monitoring of shipping / fishing traffic, minelayers and mine laying operations, and collection of environmental data such as SSP, bathymetry, mine-like object (MLO) information, clutter density, and bottom composition. This UUV system will be an excellent collection platform for environmental data in areas of tactical interest.

4.1. PRESENT UUV CAPABILITIES - UOES (FY05)

- Bottom mapping will provide the following to determine doctrinal bottom type: bathymetry, clutter density, bottom characteristics, roughness, and percent burial
- Physical oceanographic data collection of the ocean volume will provide the following: Temperature, salinity, depth, water density, water clarity, and sound speed profile
- Manual conversion and transfer of environmental data into Mine Warfare Environmental Decision Aids Library (MEDAL) and NAVO databases
- Collecting environmental data in support of the IPB:
    - To select routes
    - To select operating areas
    - To support other MCM systems and historical database
    - To determine MCM asset utilization

4.2. NEAR TERM CAPABILITIES - POC (FY06)

- Automated conversion and transfer of environmental data into MEDAL
- Expedite the transfer of environmental data

4.3. MIDTERM CAPABILITIES - IOC (FY09)

- Provide FORCEnet compliant environmental data for processing to include: MEDAL input, data fusion, and NAVO historical database archive

APPENDIX A. HOST PLATFORMS

This chapter provides a brief description of the notional host platforms.

These UUV systems may be rapidly transported to the assigned task area. Upon arrival in or near the task area, the UUVs must be deployed into the water and recovered out of the water at completion of assigned missions. Present systems use existing ship cranes and boats to execute this task. These systems are limited by sea state and environmental conditions. Future development of a dedicated launch and recovery system will expedite launch and recovery with a goal of launch and recovery within the operational envelope of the UUV.

A-1. LITTORAL COMBAT SHIP (LCS)

LCS is a high speed modular platform which can be reconfigured to meet the specific needs of missions. It will collectively add combat capability to conduct Mine Warfare (MIW), Surface Warfare (SUW), and Anti-Submarine Warfare (ASW) missions, without relying on carrier or land-based aviation assets. Its high top speed coupled with its ability to operate at economical loiter speeds will enable a rapid and focused response against a specific threat, based on the transformational modularity of the platform.

- LCS sea frames will provide common Command, Control, Communications, Computers and Intelligence (C4I) infrastructure, a common and integrated tactical control system for unmanned vehicles, utility resources such as power, compressed air, water, and common self-defense capability. The LCS force will be:
    - A distributed force deployed in groups, as compared to single, multi-mission capable ships
    - Modular in design, mission flexibility, innovative crew manning
    - Open architecture
    - Interwoven, both tactically and operationally, with traditional power projection forces
    - Able to integrate with and to leverage all-service information gathering and targeting capabilities

- Effective operations in the littoral will be characterized by speed, agility, and integration with off board systems

A-1.1. UUV SUPPORT SYSTEMS

- One common stern crane
- Plug and Play for mission modules to include; C4I, and all support services
- Specific Modular Mission Modules for UUV systems will be loaded when the mission is needed
- C4I
    - MEDAL

- Communications suite

A-2. USS AVENGER CLASS (MCM 1) MINE COUNTERMEASURE SHIP

The Avenger class is a dedicated mine countermeasure ship designed for mine hunting, and mechanical and influence minesweeping.

- Their hulls are constructed of wood with a laminated Glass Fiber Reinforced Plastic (GRP) outer shell to reduce magnetic signature.
- AN/SQQ-32 Advanced Variable Depth Mine Hunting Sonar
- AN/SLQ-48 Mine Neutralization System, Remote Operated Vehicle
- AN/SLQ-38 Mechanical Minesweeping System
- AN/SLQ-37 Magnetic/Acoustic Minesweeping System
- AN/SSN-2 Precision Integrated Navigation System

A-2.1. UUV SUPPORT SYSTEMS

- Cranes
  - Ships Boat Crane port side amidships
  - Stern Mine Sweeping Cranes located on Port and Starboard quarters.
- Ship's 10 ft Rigid Hull Inflatable Boat (RHIB)
- C4I
  - MEDAL
  - Communications suite

A-3. CRAFT OF OPPORTUNITY

The flexibility of these low impact off board sensors easily lend themselves to deployment a from COOP. There are many system specific needs that must be satisfied.

A-4. SMALL BOATS

Elements of the UUV systems can be manually deployed and recovered from small boats.

A-5. SHORE

Elements of the UUV systems can be manually deployed and recovered from the shore.

A-6. UNMANNED SURFACE VESSELS

The use of unmanned surface vessels to launch and recover UUVs could greatly expand the area of operation from the host vessel. This would require an autonomous and dedicated launch and recovery system. Capability of deployment from this host platform has not yet been developed. Additionally the Unmanned Surface Vessel (USV) comes with more expense and increased reliance on technology and our ability to achieve it.

APPENDIX B. NOTIONAL OPERATIONAL SEQUENCE

NOTIONAL OPERATIONAL SEQUENCE

The following common operational tasks are the notional sequence for UUV missions. Specific systems and missions may not require all of the tasks. As systems evolve and more autonomy is developed certain tasks may no longer be required to be performed. For the purposes of this document, the following definitions are employed:

Mission - The objective that the UUV system is assigned to complete
Sortie - An individual UUV flight from launch to recovery

B-1. PLANNING

- Determine the mission objectives
- Consider the environmental constraints, system capabilities and other limiting factors
- Determine the best mission profile for the specific objective(s)
- Determine the individual tasks to be performed within the mission(s)

B-2. PROGRAMMING

- Determine the specific sequence of UUV movements, system operations, limitations and contingencies to enable the individual vehicles to perform the assigned tasks
- Develop a vehicle or system mission program to perform the assigned tasks
- Test mission program - Run simulated mission on mission simulator (if available) to identify potential programming errors
- Install mission program into vehicle(s)

B-3. PRE-MISSION MAINTENANCE

Tasks to perform to the UUVs and supporting systems to enable successful completion of mission objectives.

- UUV Operational Checks
  - System self-check
  - Battery Status
  - Propulsion
  - Navigation System
  - Sensors
  - Communications
  - Emergency Recovery Group
- Ancillary equipment checks
  - Communication
  - Handling Equipment
  - Safety Equipment
  - Emergency Recovery Group

B-4. LAUNCH

Physical deployment of UUVs to perform pre-programmed tasks begins when vehicle enters water.

B-5. MONITORING

The direct or indirect observation of systems performance during the execution of assigned tasks, designed to distinguish when systems are performing properly, identify faults and de-conflict operating water space.

B-6. RECOVERY

Is complete when physical recovery of UUVs from the water after completion of assigned mission.

B-7. DATA DOWNLOAD

Process of removing the data collected during the performance of an assigned mission.

B-8. POST MISSION ANALYSIS

The processing of raw data to generate a concise products meeting mission objectives, to include; environmental maps, environmental conditions, sonar contact locations, high resolution sonar snippets, photos, neutralization events, assessment that contacts have sufficient characteristics to be classified as mine-like or mines .

B-9. POST MISSION MAINTENANCE

Preventive and corrective maintenance to be performed to the UUVs and supporting systems following operation. Tasks are designed to increase reliability, preparation for follow-on missions and preparation for stowage.

APPENDIX C. NOTIONAL UUV DIVE PROFILE

Dive profile is the operational sequence that a UUV performs during a sortie. Two variations of dive profiles are described; Global Positioning System (GPS) and transponder based systems. Variations in UUV system design will affect the dive profile.

C-1. GPS BASED UUV SYSTEMS

The UUV system uses satellite-positioning data to derive the position while on the surface. Once below the surface the vehicle uses inputs from onboard compasses, inertial navigation systems, and Doppler velocity logs to determine the position, speed, and direction of travel in the water volume. GPS systems can be operated without supporting navigational aids but requires periodic surfacing to collect GPS data and reduce degradation of navigational accuracy. GPS navigation systems have unlimited operating range. Dive profile for GPS based UUV systems includes the following:

- GPS synchronization prior to launch
- Launch UUV
- Navigation calibration
- Ingress – Transit from launch position to task area
- Dive to data collection depth
- Navigate data collection pattern
- Surface for GPS data collection (either planned or self determined)
- Egress – Transit to recovery position
- Recovery of UUV and associated equipment (i.e., communications buoys…)

C-2. TRANSPONDER BASED UUV SYSTEMS

The UUV system uses acoustic communications and pre-positioned transponders to determine the position in the water volume. The vehicle will continually update its position and adjust to match planned mission using inputs from transponders, onboard compasses, inertial navigation systems, and Doppler velocity logs to determine their position, speed, and direction of travel. The placing and recovering transponders are additional steps that are normally performed with small boats. The accurate placement of transponders is critical to the system navigational accuracy. The operating area limits are the acoustic range from transponders to the UUV. Dive profile for transponder based UUV systems includes the following:

- Navigational transponder placement
- Launch UUV
- Navigation calibration
- Ingress – Transit from launch position to task area
- Dive to data collection depth
- Navigate data collection pattern
- Egress – Transit to recovery position
- Recovery of UUV and associated equipment (i.e., transponders and communications buoys)

APPENDIX D. NOTIONAL ANCILLARY EQUIPMENT LIST

Equipment and software that is required to operate and/or support operation of the UUV system. This list is general. Specific UUV systems may require additional items not specified here.

- Mission Modules (LCS)
- Small Boat for launch & recovery/emergency recovery
- Programming Computer
- Post Mission Analysis Computer
- Software
    - Pre Mission Analysis
    - Mission Planning
    - Post Mission Analysis
- Storage and Shipping Containers
- Battery Charging System
- Handling equipment
- Communications equipment
- Navigation equipment
- Spare parts
- Tools
- Emergency Recovery Group Locators

APPENDIX E. INFRASTRUCTURE

This section discusses the SMCM UUV infrastructure elements to include manning, maintenance, Shore Maintenance Facility (SMF), and Training concepts. Infrastructure characteristics and processes will reflect the UUV maintenance and supportablitiy concepts for the basic UUV system. Existing infrastructure resources will be exploited to the fullest extent possible. Where required, additional support resources will be acquired to meet fleet supportablity goals. System design and maintenance features will take into consideration Human System Integration (HSI) requirements related to the operations and maintenance of the SMCM UUV system.

E-1. MANNING

To ensure technical expertise is retained during the UOES process a cadre of operators has been formed to operate these systems. It is anticipated that as the systems progreses to a POC/IOC, the tasks of the cadre will transition to the host platforms. For the purposes of this CONOPS the term cadre will include the prospective host platform operators.

It is recommended that candidates for SMCM UUV training be selected from the following source ratings: Mineman (MN), Sonar Technician (ST), Electronics Technician (ET), Operations Specialist (OS), Aerographers Mate (AG), Engineman (EN), and Boatswain Mate (BM).

E-2. MAINTENANCE CONCEPT

In an effort to reduce maintenance requirements on the operational forces two levels of maintenance will be established for the SMCM UUV system: Organizational (O-Level) and Depot Level (D-Level).

E-2.1. ORGANIZATIONAL MAINTENANCE (O-LEVEL)

Organizational – Level maintenance addresses only that maintenance (preventive or corrective) that is performed on the SMCM UUV system in the performance of tasking to include: pre-mission maintenance, post-mission maintenance, and minor repairs. The cadre performs system maintenance. Fault identification is accomplished using built-in-test (BIT) and verified technical data to isolate faulty lowest replaceable units (LRU).

E-2.2. DEPOT LEVEL (D-LEVEL)

Depot Level maintenance will be performed at the designated Shore Maintenance Facility (SMF). Depot Level maintenance is beyond the capability and/or facilities of the O-level maintenance. It will consist of fault/failure identification utilizing BIT, manual troubleshooting procedures and verified technical data, piece part repair, repair verification, and return of serviceable units to inventory. Commercial Off The Shelf (COTS) items will be returned to the original equipment manufacturer (OEM) or authorized repair contractor. SMF civilian personnel will conduct configuration control and configuration status accounting.

E-2.3. SHORE MAINTENANCE FACILITY

The SMF will possess all of the tools and test equipment necessary to complete checkout and repair of the UUVs and associated ancillary equipment. Additionally the SMF will be able to accomplish data analysis and storage, battery charging and storage, and environmentally compliant UUV wash down.

The actual SMF could be a contractor facility, a government-owned and operated facility,

or a government-owned and contractor-operated (GOCO) facility. The SMF will also be able to accommodate post overhaul/maintenance in-water test runs to include UUV pressure test to ensure UUV hull seal and internal component integrity.

Maintenance data will be collected and analyzed for refinement of the maintenance process and spare parts stock levels during SMF turn-around cycle. All fault/failure data collected on each deployment will be recorded and utilized to groom the system for redeployment.

E-3. TRAINING

A cadre of trained SMCM UUV operators/maintainers will operate and maintain the SMCM UUV system. This cadre will consist of at least one Officer, at least one Chief Petty Officer, and a core group of operators/maintainers. The exact makeup of the cadre team will be determined by a system manpower study and specific mission requirements. In support of the SMCM UUV operations, three sets of maintenance will be required: organizational level, cadre operations and maintenance, and SMF maintenance. Initial training will be provided by the prime contractor and transition to the Navy after fleet introduction, CAT/CBT insertion and inclusion of a system simulator.

E-3.1. ORGANIZATIONAL LEVEL

Training consists of a high level overview of the SMCM UUV system and general mission types as well as practical walk-through of a typical launch and recovery scenario. The cadre will provide the training to the ship/boat crew members to be involved with the launch and recovery of the SMCM UUV.

E-3.2. CADRE OPERATIONS AND MAINTENANCE

Training will consist of operations and maintenance. Operations training will be provided in the following areas: Mission sortie planning

- Pre-mission maintenance
- Launch
- In water monitoring
- Recovery
- Post mission data analysis
- Post-mission maintenance

Maintenance training will consist of pre and post launch system checkout, energy section recharge or change-out, and replacement of LRU.

E-3.3. SMF MAINTENANCE

Training consists of detailed SMF maintenance training requirements derived from Maintenance Task Analysis (MTA) required to be performed during the development phase of the program. SMF maintenance training will be provided by civilian technicians that are responsible for system maintenance and certification. Training will include the use of diagnostic programs and manual troubleshooting procedures to identify and repair 100% of all system faults/failures.

SMCM UUV training will consist of classroom and practical training on the UUV equipment. Follow-on training for new system modifications and mission requirements will be provided to the cadre as required. Training for new system modifications will follow the same concept as the SMCM UUV system training.

APPENDIX F. TACTICAL SITUATIONS (TACSITS)

These UUV systems will be an additional tool in the toolbox to support operational commanders in performing assigned MCM tasks. UUV systems will support the following tactical situations defined in the Comprehensive Mine Warfare CONOPS, currently under going fleet review.

Additional TACSITS will be developed that will address; Homeland Defense and IPB tasks along with the use of UUVs in independent and complimentary roles.

F-1. ESF MCM OPERATIONS

F-2.1. CHOKE POINT/ SEA LINE OF COMMUNICATIONS (SLOC) TRANSIT
F-2.2. PREPARATION AND CLEARANCE OF ESF OPERATING AREA
F-2.3. PORT BREAK-IN/OUT

F-2. THEATER MCM OPERATIONS

F-2.1. Q-ROUTE/SLOC CLEARANCE
F-2.2. PREPARATION AND CLEARANCE OF AMPHIBIOUS OPERATING AREA
F-2.3. PREPARATION AND CLEARANCE OF JLOTS GEOMETRIES
F-2.4. PREPARATION AND CLEARANCE OF FSA/TLAM BOX

APPENDIX G. SAMPLE APPLICATIONS OF SMCM UUVS

JAA:gwp
12 April 2005

(Not for Public Release)

APPENDIX H. REFERENCES

UUV Master Plan, November 9th, 2004

Naval Power 21

SMCMV UUV Working Group Charter, October 2004

Concept for Experimentation of Prototype Small UUVs for SMCM Ships Initiative, August 2003

Navy Strategic Plan for Small UUVs, June 2004

Memorandum of agreement (MOA) concerning surface Mine Countermeasures Vehicle (SMCMV) Unmanned Underwater Vehicle (UUV) initiative, July 2004

UUV Mission Concepts, NSWC Panama City, October 2004

Unmanned Underwater Vehicle (UUV) Platform Validation Analysis White Paper, March 2002.

Joint Publication 1-02, Standard Military Definitions

Naval Warfare Publications (NWP 3-15), Mine Warfare

Naval Warfare Publications (NWP 3-15.21), Surface Mine Countermeasures

Naval Warfare Publications (NWP 3-15.41), MCM Planning and Procedures

Allied Tactical Publication (ATP) 6 Volumes I & II

Allied Tactical Publication (ATP) 24

Comprehensive Mine Warfare CONOPS

APPENDIX I. ACRONYMS

AG	Aerographers Mate
AMCM	Airborne Mine Countermeasures
AOA	Amphibious Operating Area
ASW	Anti-Submarine Warfare
AT	Antiterrorism
BIT	Built in test
BM	Boatswains Mate
BMW	Bottom Mapping Workstation
C	Classify
C4I	Command, Control, Communications, Computers, and Intelligence
CAC	Computer Aided Classification
CAD	Computer Aided Detection
CAT	Computer Aided Training
CBT	Computer Based Training
CDD	Capabilities Development Document
CMWC	Commander Mine Warfare Command
CONOPS	Concept Of Operations
COOP	Craft of Opportunity
COTS	Commercially Off the Shelf
D	Detect
DCL	Detect Classify Localize
D-Level	Depot Level
DOTMLPF	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel and Facilities
EN	Engineman
EOD	Explosive ordnance disposal
ESF	Expeditionary Strike Force
ET	Electronics Technician
EXTAC	Experimental Tactics
FP	Force Protection
FSA	Fire Support Area
FY	Fiscal Year
GOCO	Government owned contractor operated
GPS	Global Positioning System
GRP	Glass Fiber Reinforced Plastic
HSI	Human System Interface
I	Identify
IAW	In accordance with
IOC	Initial Operational Capability
IPB	Intelligence Preparation of the Battlespace
IRT	In reference to
JLOTS	Joint Logistics Over-The-Shore
JUSS	Joint Undersea Superiority Study
L	Localize
LAN	Local Area Network

LCS	Littoral Combat Ship
LMW	Littoral Mine Warfare
LOD	Line of Departure
LOP	Lines of departure
LRU	Lowest replaceable unit
M	Map
MCM	Mine Countermeasures
MCMC	Mine Countermeasure Commander
MDA	Mine Danger Area
MEDAL	Mine Warfare Environmental Decision Aids Library
MILC	Minelike Contact
MILC	Mine Like Contact
MIW	Mine Warfare
MIWC	Mine Warfare Commander
MLO	Minelike Object
MN	Mineman
MNS	Mine neutralization system
MOA	Memorandum of agreement
MTA	Maintenance Task Analysis
N	Neutralize
NATO	North Atlantic Treaty Organization
NAVOCEANO/ NAVO	Naval Oceanographic Office
NSCT	Naval Special Clearance Team
NSFS	Naval Surface Fire Support
OEM	Original Equipment manufacturer
O-Level	Organizational Level
OMFTS	Operational Maneuver From The Sea
OPAREA	Operations Area
OPLAN	Operation Plan
OS	Operational Specialist
OTC	Officer in Tactical Command
OTH	Over The Horizon
PEO	Program Executive Office
PINS	Precision Integrated Navigation System
PMA	Post Mission Analysis
POC	Preliminary Operational Capability
PPI	Planned Position Indicator
R	Reacquire
REA	Rapid Environmental Assessment
RFOC	Rapid Follow-On Clearance
RHIB	Rigid Hull Inflatable Boat
RI	Reacquire Identification
SCM	Search Classify Map
SLOC	Sea Line Of Communications
SMCM	Surface Mine Countermeasures
SMCMV	Surface Mine Countermeasure Vessels
SMF	Shore Maintenance Facility
SPOD	Seaport Of Debarkation

SSP	Sound Speed Profile
ST	Sonar Technician
STOM	Ship To Object Maneuver
SUW	Surface Warfare
SW	Shallow Water
TACMEMO	Tactical Memorandum
TACSIT	Tactical Situation
TBMD	Theater Ballistic Missile Defense
TLAM	Tomahawk Land Attack Missile
TTP	Tactics, Techniques, and Procedures
UOES	User Operational Evaluation System
US	United States
USV	Unmanned Surface Vessel
UUV	Unmanned Underwater Vehicle
V	Verify
VSW	Very Shallow Water
WG	Working Group